REMARKS

Upon entry of this amendment, claims 1 and 4-21 are pending in the application, of which claim 15 is being amended.

Claim Objections

Claim 15 is being amended to delete the word "between" which was objected to, and is a typographical error. It should be noted that the Examiner objected to both claims 15 and 21, but only claim 15 has this error.

The claim amendments are fully supported by the Specification and add no new matter. Accordingly, entry of the claim amendments is respectfully requested.

Double Patenting

Claims 1, 6, 8-10, 13-14, 11-12, 20-21, and 17 were provisionally rejected on the grounds of nonstatutory obviousness type double patenting as being unpatentable over claims 12, 16-18 and 20 of US Patent No. 7,480,129.

Applicant is enclosing a Terminal Disclaimer to overcome this rejection.

Claim Rejections Under 35 U.S.C. § 102(b)

I. Claims 1 and 4-5 are rejected under 35 U.S.C. § 103(a) as obvious over Wang et al. (U.S. Patent No. 6,538,872) in view of Edelstein et al. (U.S. Patent No. 5,796,074)

An obviousness rejection requires that the prior art references, when combined, teach or suggest the invention as a whole. In making the assessment of differences between the prior art and the claimed subject matter, section 103 specifically requires

consideration of the claimed invention "as a whole." Princeton Biochemicals, Inc. v. Beckman Coulter, Inc. (Fed. Cir., No. 04-1493, 6/9/05). To establish obviousness, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). "All words in a claim must be considered in judging the patentability of that claim against the prior art." *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970). In determining the differences between the prior art and the claims, the question under 35 U.S.C. 103 is not whether the differences themselves would have been obvious, but whether the claimed invention as a whole would have been obvious. *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F. 2d 1530, 218 USPQ 871 (Fed. Cir. 1983).

Furthermore, "[a] patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art." KSR Int'l Co. v. Teleflex, Inc., 127 S. Ct. at 1741. Instead, in order to determine whether an invention would have been obvious, it is useful to identify some "apparent reason to combine the known elements," either by looking to the teachings of the prior art, the knowledge of one with ordinary skill in the art, or demands present in the marketplace. Id. 127 S. Ct. at 1740. "[I]t can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does." Id. at 1741.

The support 190 taught by Wang et al. does not render claim 1 obvious because Wang et al. teaches away from derivation of a detachable electrostatic chuck comprising an electrostatic puck comprising a ceramic body with an embedded electrode and a base plate bonded to the electrostatic puck by a bond layer, as claimed in claim 1. Wang et al. teaches that both the chuck 55 and the support 190 are bonded to the base 175 by a bond layer 295, and that this combination structure serves to reduce the thermal expansion stresses between the chuck 55 and the chamber 25. Specifically, Wang et al. teaches:

> The support 190 serves to secure the electrostatic chuck 55 to the chamber 25, and also perform one or more of other functions, such as reduce thermal

> expansion stresses between the chuck 55, base 175, and chamber 25; serve as a thermal insulator or thermal conductor depending upon the desired temperature of the substrate 30; and also control heat transfer rates between the substrate 30 and the chamber 25.
>
> One version of the support 190 is adapted to reduce thermal expansion stresses between the chuck 55, base 175, and the surface 50 of the chamber 25....

[Wang et al., col. 10, lines 48-57]. To support the reduction of thermal expansion stresses between the ceramic chuck 55, base 175 and the chamber 25 (which is made of metal having an entirely different thermal expansion than the ceramic chuck), Wang et al. teaches that the "base 175" is <u>bonded</u> to the "support 190" as shown in Figure 6. Specifically, Wang teaches:

> In another version, the support 190 is bonded to the base 175 of the electrostatic chuck 55 by a second bond layer 295 of compliant and ductile material that is provided to further absorb the thermal stresses that occur from differences in thermal expansion of the support 190 and the base 175.

[Wang et al., col. 11, lines 9-13]. By teaching the desirability of bonding the support 190 to the base 175 of the electrostatic chuck by the bond layer 295, Wang et al. teach away from the Examiner's suggested modification of making the Wang et al. structure into a <u>detachable</u> electrostatic chuck comprising an electrostatic puck and a bonded base plate which is separable from, and <u>not</u> bonded to, the support 190. One of ordinary skill would have no apparent reason to derive applicant's claimed chuck from the opposite teachings of Wang et al.

Further, Wang et al. also does not teach or suggest the structure of a detachable chuck comprising a base plate having an annular flange extending beyond the periphery of the ceramic body, the flange comprising holes to allow connectors to pass therethrough to render the chuck detachable from the chamber. A flange is defined as "a protruding rim, edge, rib, or collar, as on a wheel or a pipe shaft, used to strengthen an object, hold it in place, or attach it to another object." [American Heritage® Dictionary of the English Language, Fourth Edition]. The structure was derived in the present

invention to allow the chuck be detachable from the chamber by providing an extension, which can be attached and detached from the remaining portions of the chamber, from the topside of the chamber so that the entire bottom structure of the chamber does not have to be dismantled each time. This is not a trivial problem as the substrate support structure and its edges have to be designed to maintain plasma uniformity across the peripheral edge of the substrate, while still providing a structure that can be removed from the top of the chamber for maintenance or cleaning.

The claimed composite base plate having an annular flange, as claimed, is not taught by Wang et al. Instead, the base 175 taught by Wang et al. stops at the perimeter of the electrostatic puck 100, as shown in Figure 6. The Wang et al. chuck is entirely absent an annular flange that extends <u>beyond</u> the periphery of the ceramic body of the electrostatic puck 100. Wang et al. does not teach a base plate having a protruding rim, edge, rib, or collar, used to strengthen the base plate, hold it in place, or attach it to another object, *i.e.,* a base plate having a flange. Thus, Wang et al. does not teach the claimed detachable e-chuck comprising a base plate having an annular flange extending beyond the periphery of the ceramic body, as claimed in claim 1. Wang et al. does not teach or suggest derivation of a base plate having an annular flange with a plurality of holes to allow connectors to pass therethrough, as claimed in claim 1. The base 175 as taught by Wang et al. does not have a flange extending beyond the e-chuck body, and does not have holes that pass through such flange for connectors as claimed in claim 1. That is why the base 175 taught by Wang et al. is not detachable from the underlying structure.

Applicant also disagrees with Office Action's remarks that the support 190 with the threaded inserts 315, as taught by Wang et al., meets the claimed language to a detachable electrostatic chuck comprising an electrostatic puck bonded to a base plate with a bond layer, the base plate having an annular flange extending beyond the periphery of the ceramic body with holes to allow connectors to pass therethrough. The support 190 as taught by Wang et al. is not the same as the base plate which is also taught by Wang. Both are separate structures made of different materials, and each

has a separate function in the assembly holding the e-chuck as taught by Wang et al. Therefore, the Examiner cannot interchangeably substitute one for the other. If that were possible, Wang et al. would not have two separate structures. Still further, Wang et al. discloses that the support 190 has threaded inserts 315, as shown in Figure 6, to allow bolts 320 to secure the entire assembly of the electrostatic chuck 55 (an electrostatic puck 100 bonded to a base 175) bonded to the support 190 by the bond layer 295, to the chamber. Wang et al. discloses:

> "... the support 190 can comprise threaded inserts 315 ... into which bolts 320 are threaded to secure support 190 (with the electrostatic chuck 55 bonded thereto) to the chamber 15."

[Wang et al., col. 12, lines 5 – 9]. Thus, Wang et al. teaches that the support 190 is bonded to the base 175 of the electrostatic chuck by the bond layer 295, and that this entire assembly is bolted onto the chamber, and only accessible from the lower or bottom portion of the chamber as needed to remove the bolts. Wang et al. also teaches that "[t]he base 175 and the support 190 secure the electrostatic chuck 55 to the chamber 25 ..." [Wang et al., col. 5, lines 8 – 9]. Thus, Wang et al. teaches an electrostatic chuck 55 which is bonded to a support 190 by the bond layer 295 and which, consequently, is not detachable from the support 190.

As a further distinction, Wang et al. does not teach a detachable electrostatic chuck comprising a base plate having an annular flange with holes that allow connectors to pass therethrough, as claimed in claim 1. The threaded inserts 315 in the base 190 of Wang et al. do not allow connectors to pass therethrough. Instead, Wang et al. teaches that the threaded inserts 315 extend only partially through the structure of the support 190 and terminate within the support 190, as shown in Figure 6. Thus, Wang et al. does not teach a base plate having annular flange comprising a plurality of holes to allow connectors to pass therethrough, as claimed in claim 1. Further, the threaded inserts 315 in base 190 of Wang et al., as shown in Figure 6, do not extend through an annular flange of the base plate, as claimed. Instead, the threaded inserts 315 extend into the body of the base 190. The claimed holes extend through an annular flange of the base plate which extends beyond the periphery of the ceramic

body of the electrostatic puck. In contrast, the threaded inserts 315 of Wang et al. occur inward of the periphery of the ceramic body of an electrostatic puck, as shown in Figure 6, and thus, are not holes which extend through an annular flange extending beyond the periphery of the ceramic body of the electrostatic chuck, as claimed.

The claimed detachable electrostatic chuck also provides significant benefits not taught or suggested by Wang et al. which are secondary considerations that reflect the nonobviousness of the present invention. The combined structure of the claimed e-chuck, the base plate with a flange, and a plurality of holes therein to allow connectors to pass therethrough to hold the e-chuck to the chamber, is detachable from the process chamber. The claimed connector holes in the flange of the base represent a significant advancement over the structure taught by Wang et al. As the Examiner herself will see from FIG. 6, the conventional method of attaching and detaching the e-chuck 110 of Wang et al. is complex and involves fasteners 320 extending from below the surface of the structure 50 into the backside of the pedestal support 190. Further, the claimed base plate, similar to that taught by Wang et al. is made of a composite ceramic material, and consequently, it is hard to drill holes in this structure for attachment as it can easily break and chip around the edge of such a hole. One can immediately see the difficulty of assembling and disassembling the structure taught by Wang et al. from FIG. 6. The fasteners 320 have to be reached from behind the entire assembly of the e-chuck 115, base plate 175 and support 190, and still further behind the structure 50. Thus, it is clear that one of ordinary skill in the art, as evidenced by Wang et al., did not find it obvious or easy to devise a solution to attach fasteners from the front by making a base plate with a flange extend beyond the ceramic e-chuck and forming fastener holes in this flange area, and then only bonding the e-chuck to the base plate to create a detachable e-chuck as claimed. Clearly, this solution was not obvious to Wang et al., and Wang et al. does not teach a base plate having an annular flange comprising a plurality of holes to allow connectors to pass therethrough, as claimed in claim 1.

For all these reasons, Wang et al. does not teach a detachable electrostatic

chuck comprising an electrostatic puck bonded to a base plate with a bond layer, which is detachable from the chamber, as claimed in claim 1, or the claims which depend therefrom.

Edelstein et al. does not make up for the deficiencies of Wang et al. because Edelstein et al. also does not teach the claimed structure of a <u>detachable electrostatic chuck comprising an electrostatic puck having a ceramic body with an embedded electrode</u>. Edelstein et al. teaches a wafer heater assembly 8 that includes a base 32 and a chuck 36 having a wafer chucking surface 76. The chucking surface 76 taught by Edelstein et al. comprises polyimide dielectric films that sandwich an electrode. Specifically, Edelstein teaches:

> Wafer chucking surface 76 is, in this preferred embodiment, made of two dielectric layers with an electrically conductive layer sandwiched therebetween. This three-layer construction is indicated by reference numeral 90 in FIG. 4. ... The dielectric layers are preferably made from <u>a polyimide film</u> available from DuPont of Wilmington, Del. as Kaptone® KJ. The electrically conductive layer can be made of a variety of materials such as copper-surfaced cladply polyimide film, aluminum cladply polyimide film and aluminum-filled polyimide film available from Abelestik Laboratories, Rancho Dominguez, Calif. One preferred conductive layer is available from DuPont as Paralux® AP, <u>an adhesiveless composite of polyimide film bonded to copper foil</u>.

Thus, Edelstein et al. teaches a chuck comprising dielectric layers of polyimide with an electrically conductive layer sandwiched therebetween. The chuck of Edelstein et al. is completely different than the claimed electrostatic puck having a ceramic body with an embedded electrode. The polyimide sandwich chuck of Edelstein et al. is a made from flexible films of polymer with an embedded—and also flexible—film of copper. The Edelstein et al. polymer chuck is not the same as the claimed ceramic electrostatic puck, which has a rigid ceramic body. The rigid ceramic e-chuck, being made of a ceramic, has a relatively low coefficient of thermal expansion that creates a thermal expansion mismatch problem with the underlying metal components of the chamber. This requires a complex technology of bonding a base plate comprising a composite of

a ceramic material comprising pores that are at least partially filled by a metal to the ceramic e-chuck so that the composite ceramic metal base plate forms an intervening structure between the ceramic e-chuck and the metal chamber surface. This multi-layer structure enables a gradual change in the thermal expansion coefficient to form a gradation in CTE and allows the ceramic e-chuck to be held to the metal chamber surface. The thermal expansion mismatch problem which is solved by the present invention is simply nonexistent in the polymer sandwiched e-chuck taught by Edelstein et al. Thus, one of ordinary skill in the art would have no reason to substitute the polymer sandwiched e-chuck taught by Edelstein into the ceramic chuck structure taught by Wang et al.

Edelstein et al. also does not teach a base plate bonded to the electrostatic puck by a bond layer, the base plate comprising a composite of a ceramic material comprising pores that are at least partially filled by a metal as claimed. The composite ceramic/metal base plate of the present claim is used in combination with the ceramic electrostatic chuck to create a structure that is detachable from the underlying metal support without the associated thermal expansion mismatch problem of prior art ceramic chucks. Instead, Edelstein et al. teaches a metal wafer heating assembly 8 comprising a base 32, body 39 and barrier support 38, which "are all preferably made of stainless steel" [Edelstein et al., col. 5, lines 1-2]. Further, the polyimide chuck as taught by Edelstein et al. has no need for a composite base plate comprising ceramic material with pores that are filled with metal. Thus, one of ordinary skill in the art would have no apparent reason to modify the ceramic e-chuck of Wang et al. with the polyimide chuck and underlying metal base taught by Edelstein et al.

Still further, neither Wang et al. nor Edelstein et al. teaches a detachable electrostatic ceramic chuck bonded to a composite ceramic/metal base plate which has an annular flange with holes to allow connectors to pass therethrough, as recited in claim 1. Instead, Wang et al. teaches a base plate 175 without connector holes extending through an annular flange of the base plate and teaches away from a base plate made from a composite material and which has an annular flange with a plurality

of holes that allow connectors to pass therethrough. Edelstein et al. teaches a polyimide chuck bonded to a metal heater/support structure. Thus, neither Wang et al. nor Edelstein et al. teaches or suggests a composite base plate with an annular flange that extends beyond the periphery of an overlying ceramic e-chuck body, and which flange also has a plurality of holes to allow connectors to pass therethrough.

Furthermore, forming connector holes that extend through the entire thickness of a composite ceramic structure can be a difficult task when the composite material comprises a brittle ceramic material that can fracture during machining of such through holes. It is much easier to form holes in a solid metal base of the type taught by Edelstein et al. or the partial holes in the metal plate taught by Wang et al. Consequently, one of ordinary skill in the art would have no motivation to form a plurality of connector holes that extend through a composite ceramic/metal base plate or through a flange of such a composite base plate, based on the combined teachings of Edelstein et al. and Wang et al.

In addition to the reasons provided above, Wang et al. and Edelstein et al. in combination, do not render the present claims obvious under the secondary considerations test because neither reference teaches or suggests the advantages and benefits of the present claim, or provides any apparent reasons for extracting elements from either reference to create the claimed detachable electrostatic chuck based on the teachings of Wang et al. or Edelstein et al. As explained in the Specification:

> The electrostatic chuck 20 having the base plate 42 comprising the composite material and having the annular flange 46 is an improvement over conventional substrate supports because the electrostatic chuck 20 allows for the electrostatic puck 22 and base plate 42 to be easily removed from the pedestal 32 when replacement or refurbishment of one or more of the electrostatic puck 22 and base plate 42 is required. Because the exposed annular flange portion of the base plate 42 is not covered by the relatively brittle ceramic body 26, the relatively strong composite material of the annular flange 46 can be detachably directly connected to the pedestal 32 to allow for easy removal of the puck 22 and base plate 42. For example, the electrostatic puck 22 and base plate 20 can

> be detachably connected to the pedestal 32 by inserting the connector 44 through the composite material of the flange 46 and into the pedestal 32. The puck 22 and base plate 42 can then be removed from the pedestal 32 by removing the connector 44 from at least one of the base plate flange 46 and pedestal ledge 40, when one or more of the puck 22 and base plate 42 has become excessively eroded or dirtied with process residues.

[Specification, page 9, line 24 – page 10, line 5].

The Specification further teaches the specific problem of the prior art chuck fo Wang et al., namely that because the chuck was joined to the pedestal by a bond or metal braze, the entire assembly including the pedestal had to be removed from the chamber for cleaning or maintenance of the chuck:

> The detachable electrostatic chuck 20 reduces the costs associated with processing substrates with the chuck 20 by allowing the electrostatic puck 22 and/or base plate 42 to be replaced or refurbished as needed, without requiring replacement of the entire chuck 20. The base plate 42 having the annular flange 46 provides significant advantages in allowing the electrostatic chuck 20 to be directly attached to, while still easily removable from, the chamber 106. The base plate 42 and annular flange 46 can also be made from a material that is more ductile than the ceramic material of the electrostatic puck 22, to reduce the effect of thermal expansion mismatches between the chuck 20 and the underlying pedestal 32. Also, because the annular flange 46 extends outwardly from the base plate 42, an operator can more easily see and access the bolts positioned on the annular flange 46, allowing the operator to more easily remove the chuck 20 from the chamber 106 when it requires cleaning, servicing, or refurbishment. <u>In the prior art, the chuck 20 was joined to the pedestal 32 by a bond or metal braze so that the entire assembly including the pedestal 32 had to be removed from the chamber 106</u>. Also, it was more difficult to reach down to the bottom of the chamber to access the underlying attachment components to remove the entire assembly. Removal of the entire prior art assembly from the

chamber 106 can also result in possibly increased contamination of the larger surface or volume of components outside the chamber 106. In contrast, the present chuck 20 provides easier removal access, reduced thermal expansion mismatch stresses, and a smaller volume of components to remove from the chamber 106.

[Specification, page 10, line 6 – page 10, line 27]. The claimed detachable chuck solves the problems of the prior art chucks, by providing a detachable structure that can still maintain a good plasma uniformity at the edges of the substrate held by the chuck. These benefits and advantages are not taught by the chuck of Wang et al. or other cited references, and evidence secondary considerations of non-obviousness that further negate the present obviousness rejection.

For at least these reasons, the combination of Wang et al. in view of Edelstein et al. does not render obvious the detachable electrostatic chuck claimed in claim 1 or the claims dependent therefrom.

II. Claims 11-12 and 20-21 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Wang et al. in view of Edelstein et al. and Cole et al. (U.S. Patent No. 6,700,099).

Claims 12, 20 and 21 are dependent upon claim 11. Claim 11 is not obvious over the combination of Wang et al. and Edelstein et al. because the cited combination does not teach a detachable electrostatic chuck comprising an electrostatic puck comprising a ceramic body with an embedded electrode and a base plate bonded to the electrostatic puck by a bond layer, the base plate having an annular flange extending beyond the periphery of the ceramic body, the annular flange comprising a plurality of holes to allow connectors to pass therethrough, and wherein the base plate comprises a composite of a ceramic material comprising pores that are at least partially filled by a metal, as claimed in claim 11.

Cole et al. further does not cure the deficiencies of Wang et al. and Edelstein et al. because Cole et al. is not being cited to teach a detachable electrostatic chuck. Instead, Cole et al. is being cited for teaching a workpiece chuck that includes a thermal plate assembly comprising a cooling tube for circulating a cooling fluid. Thus, Cole et al. does not teach an electrostatic puck comprising a ceramic body with an embedded electrode and a composite ceramic/metal base plate bonded to the electrostatic puck by a bond layer, as claimed in claim 11. Cole et al. also does not teach a chuck comprising a composite ceramic/metal base plate having an annular flange extending beyond the periphery of the ceramic e-chuck body, the annular flange comprising a plurality of holes to allow connectors to pass therethrough and wherein the base plate comprises a composite of a ceramic material comprising pores that are at least partially filled by a metal, as claimed in claim 11.

For these reasons, the combination of Wang et al. in view of Edelstein et al. and Cole et al. do not render obvious claim 11 or the claims dependent therefrom.

III. Claims 13 and 17 were rejected under 35 U.S.C. §103(a) as being unpatentable over Wang et al. in view of Edelstein et al. and Flanigan et al. (U.S. Patent No. 6,061,414).

Claim 13 is dependent upon claim 11 and claim 17 is an independent claim. As explained above, claims 11 and 17 are not obvious over the combination of Wang et al. and Edelstein et al. because the cited combination does not teach a detachable electrostatic chuck comprising an electrostatic puck comprising a ceramic body with an embedded electrode and a composite ceramic/metal base plate bonded to the electrostatic puck by a bond layer, the base plate having an annular flange extending beyond the periphery of the ceramic body, as claimed in claims 11 and 17.

Flanigan et al. also fails to make up for the deficiencies of Wang et al. and Edelstein et al. because Flanigan et al. is not being cited for, and does not teach or suggest, a detachable electrostatic chuck comprising an electrostatic puck comprising a

ceramic body with an embedded electrode and a composite base plate bonded to the electrostatic puck by a bond layer. Instead, Flanigan et al. teaches an electrode or cooling plate between the electrostatic chuck and the pedestal, where the electrode or cooling plate is fabricated from a metal [Flanigan et al., col. 6, lines 10-30]. Flanigan et al's teachings to a cooling plate below an electrostatic chuck or puck—that is, a solid metal—do not teach the claimed composite ceramic/metal base plate comprising a ceramic material with pores at least partially filed with a metal. Further, Flanigan et al. does not teach or suggest a structure comprising a base plate composed of a ceramic material comprising pores at least partially filed with metal, as recited in claims 11 and 17. Still further, Flanigan et al. does not teach a detachable e-chuck comprising a base plate having an annular flange comprising holes to allow connectors to pass therethrough, as claimed in claims 11 and 17.

Thus, the combination of Wang et al., Edelstein et al. and Flanigan et al. does not render obvious claims 11 or 17, or claim 13, which depends on claim 11.

Should the Examiner have any questions regarding the above remarks, the Examiner is requested to telephone Applicant's representative at the number listed below.

Respectfully submitted,
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Date: August 10, 2009

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